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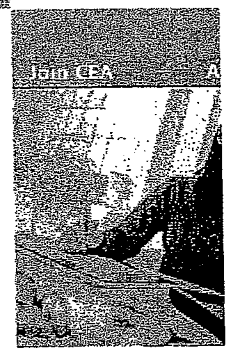

Digital America

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HDTV

No matter how large a TV picture became, or how digitally perfect the delivery, the NTSC interlaced standard could never look as good as digital video or film. The larger the picture, the worse it looked. What was needed was a higher definition digital picture that rivaled celluloid.

The race to develop HDTV began as an attempt by TV broadcasters to hold on to spectrum - portions of the public radio frequencies assigned to particular broadcasting uses. Analog television requires six MHz of spectrum per channel. HDTV needed double the lines of resolution in an analog NTSC picture. Broadcasters controlled more than the necessary six MHz, however, and used the extra spectrum to avoid interference between channels. In the early 1970s, the broadcasting industry lost a swath of this extra spectrum to "land mobile" (cellular phone) use. In the mid-1980s, the FCC was primed to award more UHF spectrum to land mobile. Broadcasters complained that wireless traffic so close to TV channels would cause static and interference, driving more people to cable.

Panasonic first demonstrated high-definition TV in 1974, displaying a picture of 1125 lines. In 1981, NHK demonstrated an analog 1125-line HDTV system, which prompted several American companies to begin exploring HDTV systems. In 1982, the Advanced Television Systems Committee (ATSC) was established by several companies to develop voluntary standards for advanced television systems. Bell Labs, RCA and its Sarnoff Research Center, MIT, and Zenith all initiated advanced television research. In 1983, several TV manufacturing companies and broadcast networks helped fund the MIT Media Lab's Center for Advanced Television Studies (CATS).

However, NHK's MUSE (multiple subnyquist sampling encoding) was the only working HDTV system, and the National Association of Broadcasting (NAB) invited the Japanese to give a public demonstration of MUSE in Washington, D.C., on January 7, 1987.

The MUSE demonstration was spectacular. The success of MUSE prompted Congress to urge American companies to come up with an HDTV standard. As a result, in April 1987, the FCC decided not to

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reallocate the additional spectrum to land mobile. A few months later, the FCC created ACATS – the Advisory Committee on Advanced Television Service – headed by former FCC chair Richard E.Wiley. Wiley and ACATS declared an open competition for the creation of an American HDTV system. ACATS received 23 proposals.

From November 14 through 18, a time frame since known as "Hell Week," proponents of each of the 23 proposals sweated through grilling from the committee. After the smoke cleared, there remained only four viable contenders: A slightly different version of MUSE called Narrow MUSE, an analog enhanced TV system called ACTV (Advanced Compatible Television) from RCA and its Sarnoff Labs, a number of patented technologies developed by MIT's CATS, and a system from Zenith. ACATS declared that working systems would undergo evaluation in early 1990 at the newly established Advanced Television Test Center (ATTC) being built in Alexandria, Virginia.

Many of the companies decided to form partnerships to increase their chances of building the winning system. In early 1989, Zenith signed a co-development deal with AT&T's Bell Labs to help it design a partly digital TV system. A year later, RCA, Sarnoff Labs, Philips and NBC joined forces in the Advanced Television Research Consortium (ATRC) to develop its own digital HDTV system. Meanwhile, the analog MUSE system went on the air on June 3, 1989, in Japan with a one-hour show featuring New York Harbor and the Statute of Liberty.

While politicians, engineers and corporate executives battled for HDTV supremacy on the east coast,Woo Paik, an engineer at the California-based cable converter company General Instrument (GI), was charged with developing a digital high-definition signal for satellite TV. In about a year Paik and his team succeeded in compressing the Tom Cruise action film "Top Gun" so it could be digitally transmitted. On May 31, 1990, after additional work, the tiny GI publicly demonstrated its digital HDTV DigiCipher converter, catching the FCC and the entire industry off-guard. In February 1991, GI and MIT formed a separate partnership to develop a progressive scan digital HDTV system.

Wiley announced that the ATTC would begin physical evaluations of the contending HDTV systems. These tests, which lasted eight weeks for each system, began in July 1991 with RCA's analog "enhanced" ACTV system. NHK's Narrow MUSE was next, followed by GI with the first complete digital high-definition television system, a 1050-line interlaced system, complete with a transmission system built by Paik, which worked to near perfection. Both GI and Zenith-Bell Labs held successful public demos after their ATTC tests. In June 1992, the RCA-Philips consortium's ATRC system was tested by the ATTC, and in August 1992, the combined GI-MIT system, a 787.5-line progressive scan system was submitted for testing.

After evaluating all the results,Wiley decided that none of the systems measured up. Wiley figured that the best strategy was to take the finest ideas from the most ingenious minds in the leading companies to create the ultimate HDTV solution. After some cajoling by Wiley, on May 24, 1993,Wiley forged all the major HDTV players into a group effort dubbed the "Grand Alliance." AT&T and GI would construct the compression encoder; Sarnoff would build the "transport," which organized the digital bitstream; Philips would build the TV set decoders and Zenith the transmission system. The emerging MPEG-2 digital video standard was mandated as the compression standard, Dolby Digital (AC-3) was picked as the HDTV audio standard, and 8-VSB (8-level Vestige Side Band) was chosen as the transmission standard.

By this time, it began to dawn on broadcasters that their successful call for HDTV had committed them to billions of dollars of infrastructure rebuilding. Over the following years, broadcasters started to stall on upgrading to HDTV. At the same time, Congress decided to auction off spectrum, rather than simply licensing it to purely commercial interests.

Another hurdle appeared in mid-1994 when proponents of a new modulation scheme called COFDM – Coded Orthogonal Frequency Division Multiplexing challenged 8-VSB. But after some tests, 8-VSB remained the standard.

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There were more challenges to the Grand Alliance throughout 1994 and into early 1995. The PC industry complained about interlacing and demanded a progressive scan HDTV standard. Broadcasters continued to complain about the costs of building new transmission towers. Cable providers complained about "must-carry" rules that would force them to carry both the analog and the new digital channels at the same time. And Hollywood directors complained that the widescreen 16:9 standard would still mean their films would have to be cropped or require letterboxing.

By September 1995, there had been several successful transmission field tests in Charlotte, NC. In December, Zenith announced that 8-VSB was finished, Dolby announced AC-3 was done, and Sarnoff indicated its transport was completed. GI and Bell Labs finished the decoder. In mid-April, the ATTC began its evaluation of the two finished digital formats, a 1080-line interlaced system and a 720-line progressive scan system, both now officially adopted as the ATSC Digital Television Standard.

A week later, the FCC opened proceedings for comments on the proposal. Wiley asked the ATSC to come up with lower resolution 480i and 480p "standard definition" formats in both 4:3 and 16:9. These additional standards brought the final total to 18 separate digital television formats, which were adopted by the ATSC on September 15. In its final official meeting on Nov. 28, ACATS officially adopted the Grand Alliance standard. On December 12, the FCC finally opened hearings on the standard.

In the meantime, more and more members of Congress latched onto the idea of auctioning spectrum. But this idea was thwarted when Congress passed the Telecommunications Act of 1995 on February 2, 1996. It was the first update of the country's telecommunications laws in 60 years and, eventually and controversially, gave broadcasters free spectrum for HDTV.

On June 17, 1996,WRAL, the CBS affiliate in Raleigh, North Carolina, applied for and received the first ATSC HDTV license. But the honor of the nation's first commercial HDTV broadcast went to WRC, an NBC affiliate in Washington, D.C., when it began HDTV transmissions on WHD-TV, channel 34 in August 1996. Except the only TV initially capable of receiving the broadcasts was in the station manager's office.

Throughout the rest of the summer, debate continued on the ATSC standard. On November 25, 1996, the broadcast, consumer electronics industry and the PC industry reached an agreement and urged the FCC to adopt the ATSC standards. On Christmas Eve 1996, nine years after the formation of ACATS, the FCC finally adopted the ATSC standard.

In January 1998, TV manufacturers showed off the first HDTVs at the Consumer Electronics Show (CES). By September, the first HDTV sets, from Mitsubishi and Panasonic, reached stores - just in time for the first HDTV network broadcasts, due to begin November 1. CBS was ahead of schedule when, on October 29, it broadcast the launch of the John Glenn space shuttle mission. Twenty-three local stations around the country began HDTV broadcasts Sunday morning, November 1, 1998. Network HDTV broadcasting was inaugurated that evening on ABC with the movie, "101 Dalmatians" on "The Wonderful World of Disney." The following weeks saw myriad HDTV broadcasting firsts. CBS broadcast the first HDTV NFL game, the New York Jets versus the Buffalo Bills, on November 8. PBS broadcast its first HDTV program. The first regular season series HDTV broadcast was CBS's "Chicago Hope" on November 18.

But the broadcasters didn't want to spend hundreds of thousands of dollars to pump out programming if no one had sets to watch them on. And consumers would only buy sets if there were something to watch. On May 9, 1999, to break this Catch- 22,Mitsubishi announced it would sponsor CBS's primetime HDTV schedule starting in the fall. Three weeks later, Panasonic announced it would loan ABC HDTV gear so the network could broadcast Monday Night Football games and Super Bowl XXXIV in HD. This started a trend in manufacturer-sponsored network HDTV fare that still continues as the transition to digital broadcast continues.

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Even with hardware manufacturing backing, not all local broadcasters wanted to upgrade to HDTV and looked for ways to derail the ATSC standard. In mid-1999, Sinclair, a 59-station broadcast group based in Baltimore, again challenged 8-VSB modulation and asked the FCC to allow broadcasting using COFDM instead. During the summer of 1999, Sinclair held a series of demonstrations to illustrate the superiority of COFDM. Sinclair complained that 8-VSB was prone to "multipath distortion" – the tendency of an HDTV signal in a heavy urban area to bounce off buildings and create double images. Sinclair insisted that COFDM was not prone to these problems.

On September 30, after a series of tests, the FCC once again sided with 8-VSB. But Sinclair didn't accept the FCC findings. In the fall of 1999, Sinclair and nearly half of all the nation's public and commercial stations petitioned the FCC to revise the ATSC standard. Over the next year, wrangling between broadcasters and the FCC continued. On January 19, 2001, the FCC reaffirmed 8-VSB once, for all and forever. The commission also eased the cable "must carry" complaint by not requiring cable operators to carry both analog and digital broadcasts from a single station.

The COFDM debate was the last major organized attempt to derail the transition to digital television, but problems still remained. In early 2000, CEA and the cable industry reached an agreement on delivering HDTV via cable. In May 2001, the onemillionth digital television was sold.

On December 19, 2002, one of the final HDTV technical hurdles was surmounted. TV makers and cable operators agreed on a set of "plug-and-play" specifications, including the use of Fire Wire and DVI connectivity, that will make all digital televisions HDTV cable compatible. The first of these HDTV cable-compatible sets reached stores in late 2003.

Next

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EXHIBIT 5

EIA RS-343-A

EIA STANDARD

Electrical Performance Standards for High Resolution Monochrome Closed Circuit Television Camera

RS-343-A

(Revision of RS-343)

ELECTRONIC INDUSTRIES ASSOCIATION ENGINEERING DEPARTMENT EIA

September 1969

Engineering Department

ELECTRONIC INDUSTRIES ASSOCIATION

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ELECTRICAL PERFORMANCE STANDARDS FOR HIGH RESOLUTION MONOCHROME CLOSED CIRCUIT TELEVISION CAMERA

(From EIA Standard RS-343 and Standards Proposal No. 1025 formulated under the cognizance of EIA Committee TR-17 on Closed Circuit Television.)

1. INTRODUCTION

The Electrical Performance Standards for High Resolution Monochrome Closed Circuit Television Equipment given here represent, it is believed, the best agreement between the members of the Closed Circuit Television Committee, who drafted these Standards, consistent with the rapidly developing state-of-the-art.

The Standards consist of (1) Definitions, (2) Minimum Standards, and (3) Methods of Measurement, for those parameters believed to be of importance.

These Standards are intended to apply only to locally generated signals; that is, signals generated in the camera itself or at a nearby point where control can be exercised over picture quality.

This Standard is written to encompass equipment which operates in the range from 675 to 1023 scanning lines with a field rate of 60 hz, interlaced 2:1. It is understood that special requirements may require different line numbers. It is recommended that one of the following be considered to satisfy particular requirements: 675, 729, 875, 945, or 1023 lines.

The tolerance on any line number in this specification shall be ± 1%.

2. CAMERA OUTPUT – VIDEO

Definition – The camera output terminals are defined as the junction between the camera or switching facilities and the line feeding either a transmission system or a visual display. The camera output signal is that signal which appears across the camera output terminals.

In this document any reference to camera output refers to the output of the camera channel whether it is a single unit or a multi-unit system.

The standard signal which will be discussed below is the signal which appears across the output terminals of the camera when they are connected to the standard load impedance.

The signal which appears across the line feeding either a transmission system or a visual display may be different from the standard signal. This is because the circuit may be equalized on an overall transmission basis and not with a view to keeping the input impedance of the line a specified value.

Under these conditions monitoring measurements made at the output terminals of the camera must be properly interpreted.

2.1 Impedance

Definition – The complex ratio of voltage to current in a two-terminal network, expressed in ohms.

Minimum Standard – The standard load impedance of the camera output shall have a value of 75 ohms ± 5% over the frequency range of 0 to 10 MHz and shall be connected for single-ended operation.

Method of Measurement – It is recommended that the load impedance for the camera be measured by means of impedance bridges capable of an accuracy of ± 1% in the vicinity of 75 ohms.

2.2 Direct Current in Output

Minimum Standard – The open-circuit DC voltage of the camera output shall not exceed 2 volts. The short-circuit DC current shall not exceed 2 milliamperes. These DC values are presumed to be independent of the output signal.

Method of Measurement – The open-circuit DC voltage should be measured with a voltmeter of at least 20,000 ohms per volt. The short-circuit DC current should be measured with a milliammeter of, at most, 10 ohms internal resistance.

2.3 Polarity

Definition – The sense of the potential of a portion of the signal representing a dark area of a scene relative to the potential of a portion of the signal representing a light area. Polarity is stated as "black-negative" or "black-positive".

Standard.– The standard polarity of the output of the camera shall be black-negative.

Method of Measurement – It is recommended that signal polarity be measured by means of an oscilloscope of known deflection polarity.

2.4 Composite Picture Signal*

Definitions:

Picture Signal – The signal resulting from the scanning process.

Sync Signal – The signal employed for the synchronization of scanning.

Sync Level – The level of the peaks of the sync signal.

Blanking Level – That level of a composite picture signal which separates the range containing picture information from the range containing synchronizing information. (This term should be used for controls performing this function.)

Black Peak – A peak excursion of the picture signal in the black direction.

2.4 *(Continued*

White Peak – A peak excursion of the picture signal in the white direction.

Reference White Level – The picture signal level corresponding to a specified maximum limit for white peaks.

Reference Black Level – The picture signal level corresponding to a specified maximum limit for black peaks.

Setup – In television, the ratio between reference black level and reference white level both measured from blanking level. It is usually expressed in percent. (This is equivalent to the difference in level between reference black level and blanking level, expressed in IRE units).

Composite Picture Signal – The signal which results from combining a blanked picture signal with the sync signal.

Blanked Picture Signal – The signal resulting from blanking a picture signal. (This signal may or may not contain setup. A blanked picture signal with setup is commonly called a non-composite signal.)

Level (in television)

Signal amplitude measured in accordance with specified techniques.

A specified position on an amplitude scale applied to a signal waveform.

Standard – It shall be standard that the blanked picture signal with setup (non-composite), as measured from blanking level to reference white level across the standard load impedance of the camera, be 0.714 ± 0.1 volt (100 IRE units).

It shall be standard that the synchronizing signal as measured across the standard load impedance of the camera be 0.286 ± 0.05 volts (nominally 40 + IRE units).

It shall be standard that the setup be 7.5 ± 5 IRE units (2.5% to 12.5% of the blanked picture signal).

Method of Measurement – It is recommended that the signal voltage output of the camera be measured by means of an oscilloscope capable of measuring such a signal with an accuracy of ± 2% of the actual value over the voltage range of 0.2 to 1.5 volts. The oscilloscope should incorporate a linear scale having a zero line which can be aligned with blanking level and divisions extending to at least 100 in the white direction and to at least 50 in the black direction. Some means of calibration should be provided so that signal level measurements can be made in volts as well as in IRE units.

*Measurement of signal levels shall be made in accordance with 58 IRE 23.S1, IRE Standards on Television: Measurement of Luminance Signal Levels, 1958 or latest revision thereof. This standard defines the levels of a Television signal in terms of IRE units. Reference white level is + 100 IRE units; blanking level is 0 IRE units; sync level is -40 IRE units. Thus the peak-to-peak level of a signal extending from reference white to sync tip is 140 IRE units.

2.5 Picture Fidelity

2.5.1 *Geometric Distortion*

Definition – Any aberration which causes the reproduced picture to be geometrically dissimilar to the perspective plane projection of the original scene.

Minimum Standard – It shall be standard that no picture element be displaced from its true position referred to the subject by more than 2% of the picture height. It is desirable that the distortion be held as much below this minimum standard as conditions permit. The instantaneous apparent scanning velocity, since it is a measure of the magnification of the system, shall vary from the mean velocity in a gradual fashion.

Method of Measurement – It is recommended that the method of measurement specified in IEEE 202, 54 IRE 23, S1, Standards on Television: Methods of Measurement of Aspect Ratio and Geometric Distortion, 1954 or latest revision thereof, be used. In this method, a chart such as the "EIA Linearity Chart" is televised by the equipment to be checked. An electrically generated time pattern is mixed with the picture signal and the resultant is displayed on a suitable picture monitor.

The EIA Linearity Chart contains a rectangular array of circles whose radii are 1 and 2% of picture height. The electrical pattern generator provides an array of horizontal and vertical bars or dots to match the chart. The picture channel linearity controls are adjusted until the two superimposed patterns fall within the 2% tolerance circles of the chart as viewed on the picture monitor. Reasonable monitor geometric distortion will have negligible effect on the accuracy of measurement.

2.5.2 *Resolving Power*

Definitions:

Resolution – In television, a measure of ability to delineate picture detail.

Limiting Resolution – In television, a measure of resolution usually expressed in terms of the maximum number of lines per picture height discriminated on a test chart. *Note:* For a number of lines N (Alternate black and white lines) the width of each line is 1/N times the picture height.

Resolution Response – In Television, the ratio of 1) The peak-to-peak signal amplitude, given by a test pattern consisting of alternate black and white bars of equal width corresponding to a specified line number, to 2) The peak-to-peak signal amplitude, given by large area blacks and large area whites having the same luminance as the black and white bars in the test pattern.

2.5.2 *(Continued)*

Line Number, Television – In measuring resolution, the ratio of the frame height to the width of each bar of a test pattern composed of alternate equal width black and white bars, as projected on the frame.

Performance – For typical system performance refer to Table 1.

Method of Measurement – It is recommended that the methods of measurement specified in IEEE 208, 60 IRE 23.S2, Standards on Video Techniques: Measurement of Resolution of Camera Systems, 1961 or latest revisions thereof, be used. In these methods a chart such as the "EIA Resolution Chart" is televised by the camera to be checked.

For the measurement of limiting resolution, the picture signal is applied to a picture monitor properly adjusted per the IEEE Standard above. The limiting horizontal and vertical resolution is determined by observing the point at which the individual lines of the graduated wedges are no longer distinguishable as separately defined images. For the measurement of horizontal resolution response, the picture signal should be applied to a line selector oscilloscope, having a video bandwidth equal to or greater than the specified bandwidth of the television camera and a picture monitor. The picture monitor is used to observe which line number wedge is being displayed on the oscilloscope. The oscilloscope is adjusted to view the peak-to-peak amplitude of the camera video signal corresponding to the desired line number wedge. The ratio of this amplitude to the peak-to-peak reference video signal corresponding to the horizontal black bars and the white background is the horizontal resolution response.

2.5.3 *Aspect Ratio*

Definition – The ratio of the frame width to the frame height. (The following auxiliary definitions are needed to clarify the aspect ratio definition).

Frame – The total area, occupied by the picture, which is scanned while the picture signal is not blanked.

Minimum Standard – The standard aspect ratio of a frame in television shall be 4 to 3 or 1:1. No specific tolerances are assigned to this ratio but it is understood that the tolerance allowed for geometric distortion will provide adequate limits for permissible variation in the aspect ratio.

Method of Measurement – If the image of the standard test chart is focused on the photosensitive surface of the camera tube, and the camera scanning is adjusted so that the regular boundaries of the chart coincide with the limits of blanking as viewed on a picture monitor, then the aspect ratio is standard, (4 to 3).

2.5.4 *Gray Scale*

Definition – The ability of a camera to reproduce luminance variations in a scene usually expressed as the number of steps of gray discernible at the output of the camera.

HIGH RESOLUTION TV SYSTEM PARAMETERS

Lines/ Frame	(1) Active Lines	(2) Ver. Res Rv	(3) f_h KHz	(4) t_h usecs	(5) t_{h_a} usecs	Fundamental Generated Frequency (MHz) (8): R_hMHz(6) 4:3(7)	R_hMHz(6) 1:1	$R_h = R_v$(9) 4:3	$R_h = R_v$(9) 1:1	R_h = 800 lines 4:3	R_h = 800 lines 1:1	R_h = 1000 lines 4:3	R_h = 1000 lines 1:1
675	624	425	20.25	49.38	42.38	63.6	84.8	6.69	5.01	12.6	9.44	15.7	11.8
729	674	475	21.87	45.72	38.72	58.1	77.4	8.18	6.13	13.8	10.3	17.2	12.9
875	809	575	26.25	38.09	31.09	46.6	62.2	12.3	9.25	17.2	12.9	21.4	16.1
945	874	600	28.35	35.27	28.27	42.4	56.5	14.1	10.6	18.9	14.1	23.6	17.7
1023	946	650	30.69	32.58	25.58	38.4	51.2	16.9	12.7	20.8	15.6	26.1	19.5

Vertical Blanking = 1250 usecs. nominal.

Horizontal Blanking = 7 usecs. nominal.

Notes:

(1) Active Lines = Lines/Frame less those occurring during vertical blanking.
(2) Vertical Resolution = Active Lines times Kell Factor (0.7). Vertical Resolution rounded to nearest 25 lines.
(3) f_h = Horizontal scanning frequency.
(4) t_h = Total horizontal line time.
(5) t_{h_a} = Total active horizontal line time (t_h – 7 usecs.).
(6) R_h/MHz = Lines of horizontal resolution per MHz of bandwidth.
(7) Aspect Ratio.
(8) Fundamental generated frequency required to provide indicated resolution in lines per picture height.
(9) Fundamental generated frequency required to provide horizontal resolution equal to vertical resolution.

TABLE 1

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2.5.4 *(Continued)*

Method of Measurement – The camera shall be set up to view the EIA Resolution Chart. The camera output shall be viewed on either an oscilloscope or monitor. All ten steps of the gray scales shall be discernible (Refer to instruction on EIA test charts).

2.5.5 *Signal-To-Noise*

Definition – Signal-to-noise ratio (48 IRE 2, 11, 15.S1)

The ratio of the value of the signal to that of the noise.

Note 1: This ratio is usually in terms of peak values in the case of impulse noise and in terms of the root-mean-square values in the case of random noise.

Note 2: Where there is a possibility of ambiguity, suitable definitions of the signal and noise should be associated with the term; as, for example: peak-signal to peak-noise ratio: root-mean-square signal to root-mean-square noise ratio; peak-to-peak signal to peak-to-peak noise ratio, etc.

Note 3: This ratio is often expressed in decibels.

Note 4: This ratio may be a function of the bandwidth of the transmission system.

Method of Measurement – At the present time no standard exists. When such a standard has been developed it will be incorporated into this document.

2.5.6 *Shading*

Definition – A large area brightness gradient in the reproduced picture, not present in the original scene.

Method of Measurement – At the present time no standard exists. When such a standard has been developed it will be incorporated into this document.

2.5.7 *Sensitivity*

Definition – A factor expressing the incident illumination upon a specified scene required to produce a specified picture signal at the output terminals of a television camera.

Method of Measurement – At the present time no standard exists. When such a standard has been developed it will be incorporated into this document.

2.6 Sync Signal Tolerance

Definition – It shall be standard that the synchronizing signal waveform at the output of the picture line amplifier conform with Figure 1, Composite Video Waveform High Resolution Monochrome Television Camera.

2.6 *(Continued)*

Minimum Standard – It shall be standard that the time of occurrence of the leading edge of any horizontal pulse "N" of any group of twenty horizontal pulses not differ from "NH" by more than 0.001H where "H" is the average interval between the leading edges of horizontal pulses as determined by an averaging process carried out over a period of not less than 4% or more than 20% of the total number of scan lines.

It shall be standard that the rate of change of the frequency of recurrence of the leading edges of the horizontal sync pulses appearing in the picture line amplifier output not be greater than 0.15 percent per second, the frequency to be determined by an averaging process carried out over a period of not less than 4% or more than 20% of the total number of scan lines, such lines not to include any portion of the vertical blanking signal.

It shall be standard that the frequency of horizontal and vertical scanning pulses not vary from the values established by the standards of frame frequency and number of scanning lines by more than ± 0.5%.

Method of Measurement – It is recommended that pulse amplitudes be measured in peak-to-peak volts. This can be done satisfactorily with an oscilloscope and a calibrated comparison signal. Accuracy of measurement should be at least ± 2%. The time of rise is the time required for changing from 10 percent to 90 percent of normal amplitude. The time of decay is the time required for changing from 90 percent to 10 percent amplitude. Peak pulse width should be the width measured at 90 percent amplitude. Base pulse width should be the width measured at 10 percent amplitude. Pulse interval measurements should be made between corresponding points on the pulses. The width of the vertical pulse, as well as the phase relationship between this pulse and the other blanking and synchronizing pulses can be determined by the "pulse cross" method. To do this a monitor is synchronized in such a manner that the vertical blanking bar appears horizontally near the center of the picture and the horizontal blanking bar appears vertically through the center of the picture. A substantial increase invertical deflection amplitude of the monitor allows details to be seen more easily.

The allowable variations in timing between successive horizontal pulses is measured in terms of percent of a horizontal scanning period. This can be measured on the same monitor used to indicate the "pulse cross" if the horizontal scanning has automatic frequency control with a sufficiently long time constant to give substantially constant frequency over a period of 20 lines.

Accuracy of measurement will depend on the maximum amount of horizontal scanning available, the resolution of the cathode ray tube, and the wave front steepness of the pulses supplied to the grid of the cathode ray tube.

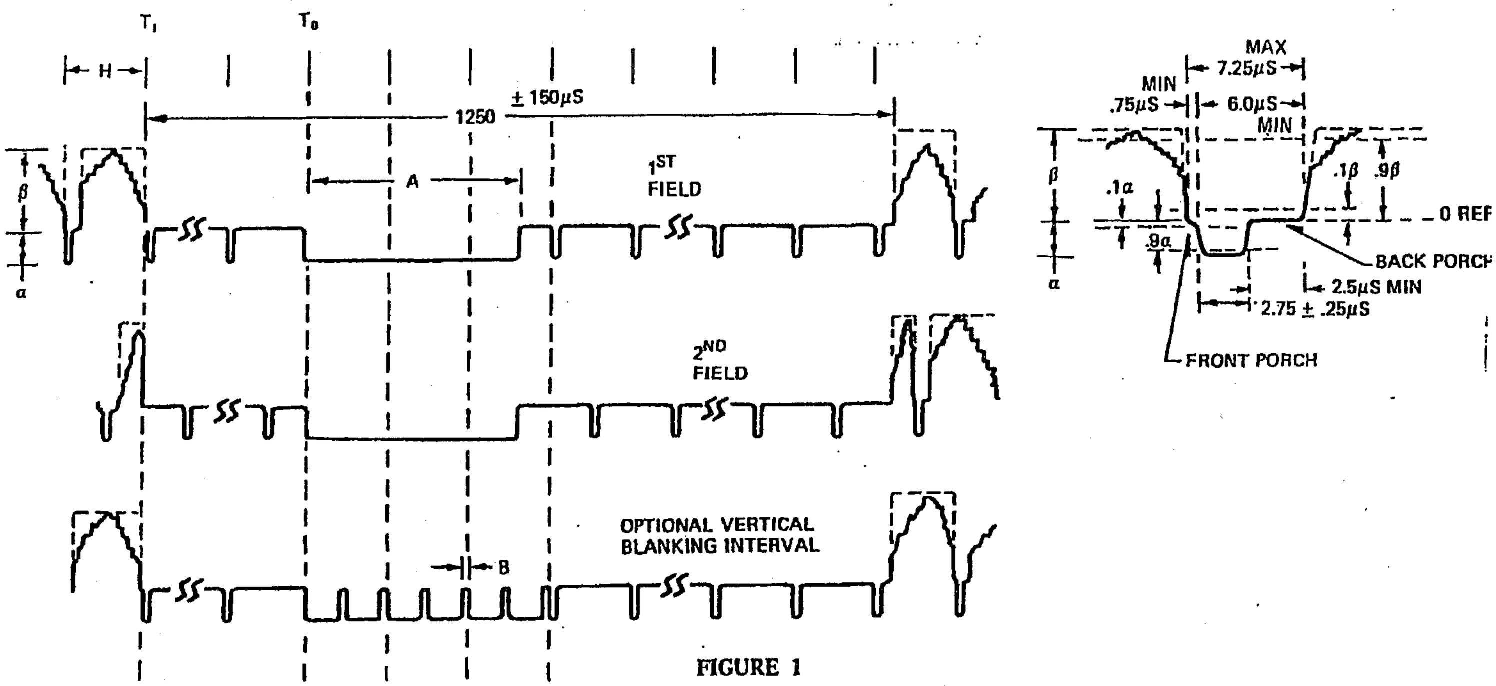

FIGURE 1

COMPOSITE VIDEO WAVEFORM HIGH RESOLUTION MONOCHROME TELEVISION CAMERA

NOTES:

1. β = 0.714 ± 0.1 volts (100 IRE Units).
2. α = 0.286 (40 IRE Units) nominal.
3. Sync to total signal ratio $\left(\frac{\alpha}{\beta + \alpha}\right)$ = 28.6 ± 5%.
4. Blanking = 7.5 ± 5 IRE Units (2.5% to 12.5% of β).
5. Horizontal Rise Times measured from 10% to 90% amplitudes shall be less than 0.1 μ/s.
6. Overshoot on horizontal blanking signal shall not exceed 0.02β at beginning of front porch and 0.05β at end of back porch.
7. Overshoot on sync signal shall not exceed 0.05β.
8. T_0 = start of vertical sync pulse.
9. T_1 = start of vertical blanking.
10. $T_1 = T_0 \begin{smallmatrix} +0 \\ -250 \end{smallmatrix} \mu/s$
11. A - vertical sync pulse = 125 ± 50 μ/s measured between 90% amplitude points.
12. Rise and fall times of vertical blanking and vertical sync pulse, measured from 10% to 90% amplitudes, shall be less than 5 μ/s.
13. Tilt on vertical sync pulse shall be less than 0.1α.
14. If horizontal information is provided during the vertical sync pulse it must be at 2H frequency and as shown in the optional vertical blanking interval waveform.
15. B - vertical serration = 2 ± .5 μ/s measured between the 90% amplitude points. Rise time measured from 10% to 90% amplitudes shall be less than 0.1 μ/s.
16. If equalizing pulses are used in the vertical blanking interval waveforms they shall be 6 in number preceding and following the vertifcal sync pulse, be at 2H frequency and 1/2 the width of H sync pulse.
17. It is recommended that for proper interlace the time duration between the leading edge of vertical sync and the leading edge of horizontal sync be a multiple of H/2.